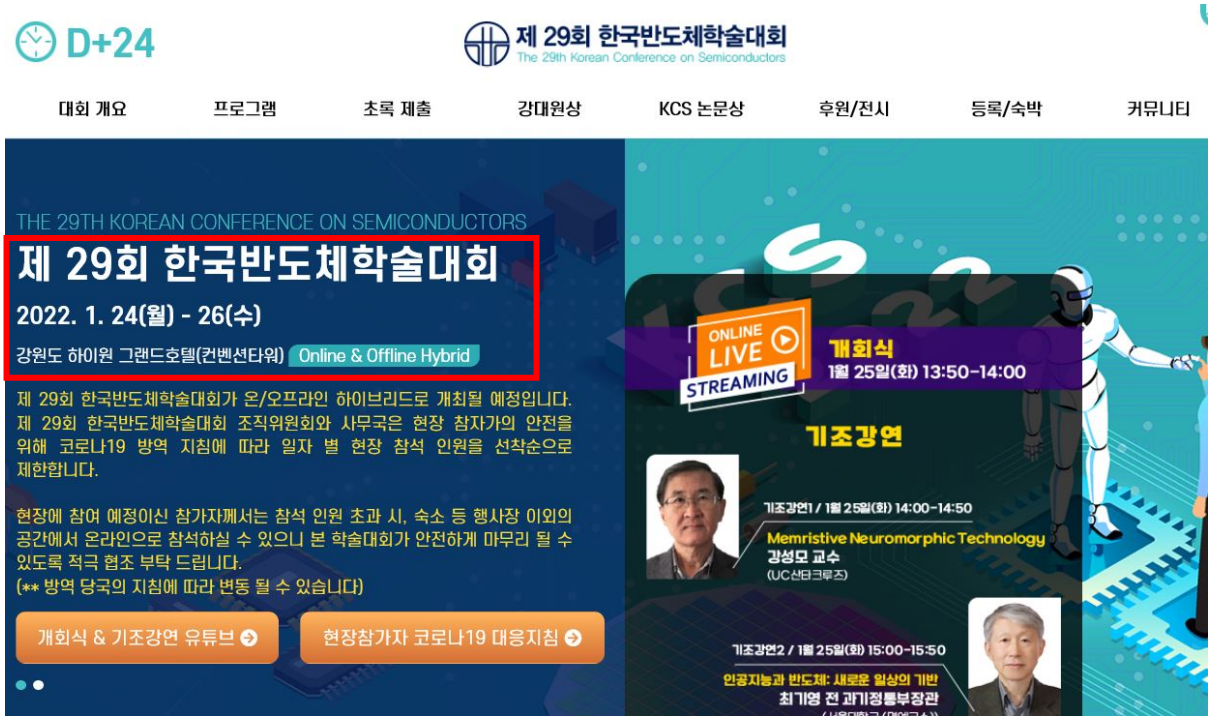

1월 26일 (수)	5층					6층							5~6층
	Room A	Room B	Room C	Room D	Room E	Room F	Room G	Room H	Room I	Room J	Room K	Room L	로비
	에메랄드 I	에메랄드 II+III	사파이어 I	사파이어 II+III	루비 II	스페이드 I	스페이드 II+III	하트 I	하트 II	하트 III	다이아몬드 I	다이아몬드 II	
09:00-10:30	WA1-D	WB1-D	WC1-Q	WD1-K	WE1-U	WF1-G	WG1-J	WH1-E	WI1-M	WJ1-H	WK1-F	WL1-C	
	Thin Film Process II	Two-dimensional Materials	Metrology, Inspection, and Yield Enhance-ment I	Artificial Neural Network Appli-cations	Bio-medical Circuits Design (바이오-메디컬용 반도체 회로설계)	Memory Devices and Advanced Modeling	Neuromor-phic Electronics II	Compound Semicon-ductor III	RF Circuits and Wireless Systems I	Imaging Technology	Photonic Device Technology	Oxide Materials II (산화물 II)	
10:30-10:45	휴식												
10:45-12:30	WA2-D	WB2-D	WC2-Q	WD2-K	WE2-U	WF2-G	WG2-J	WH2-E	WI2-M	WJ2-H	WK2-F	WL2-C	
	Thin Film Process - Metallic Films	Ferroel-ectrics	Metrology, Inspection, and Yield Enhance-ment II	Processing and Analysis of Emerging Memory	Bio-medical Semiconductor Application (바이오-메디컬용 반도체 응용)	Ab-initio Simulation and Quantum Transport	Functional Electronic Materials II	Compound Semicon-ductor IV	RF Circuits and Wireless Systems II	Display Technology I	Neuromor-phic Device Application	Advanced Characteri-zation	전시 (로비 5-6층) 및

제 29회 한국반도체학술대회
The 29th Korean Conference on Semiconductors
2022년 1월 24일(월)~ 26일(수) | 강원도 하이원 그랜드호텔(컨벤션타워)

2022년 1월 26일(수), 09:00-10:30
Room K (다이아몬드 I, 6층)

F. Silicon and Group-IV Devices and Integration Technology 분과
[WK1-F] Photonic Device Technology

좌장: 조성재 교수(가천대학교)

WK1-F-1 **09:00-09:15**	**Capacitance Matching for a Non-volatile SIS Optical Phase Shifter with an HZO MFM Capacitor** Jae-Hoon Han[1], Seung-Min Han[1,2], Dae-Hwan Ahn[1], Woo-Young Choi[2], and Jin-Dong Song[1] *[1]Center for Opto-Electronic Materials and Devices, KIST, [2]Department of Electrical and Electronic Engineering, Yonsei University*
WK1-F-2 **09:15-09:30**	**Free-Carrier Absorption-Assisted Photodetection Using A TiO_x/Ti/TiO_x Tri-Layer Film-Based Waveguide Bolometric Detector for Si Photonic Sensors** Joonsup Shim[1], Jinha Lim[1], Dae-Myeong Geum[1], Jong-Bum You[2], Joon Pyo Kim[1], Woo Jin Baek[1], Jae-Hoon Han[3], and SangHyeon Kim[1] *[1]KAIST, [2]NNFC, [3]KIST*
WK1-F-3 **09:30-09:45**	**Non-Volatile Resonance Wavelength Shift of a Si PN Ring Resonator with an HZO Ferroelectric Capacitor** Seung-Min Han[1,2], Dae-Won Rho[2], Dae-Hwan Ahn[1], Jin-Dong Song[1], Woo-Young Choi[2], and Jae-Hoon Han[1] *[1]Center for Opto-Electronic Materials and Devices, KIST, [2]Department of Electrical and Electronic Engineering, Yonsei University*
WK1-F-4 **09:45-10:00**	**Performance Estimation of a Highly Efficient and Low-loss KTN Optical Phase Shifter for Silicon Photonics** Seong Ui An, Yu Shin Kim, Seung Hyeon Han, and Younghyun Kim *Department of Photonics and Nanoelectronics, BK21 FOUR ERICA-ACE Center, Hanyang University*

Non-Volatile Resonance Wavelength Shift of a Si PN Ring Resonator with an HZO Ferroelectric Capacitor

Seung-Min Han[1,2,3], Dae-Won Rho[2,3], Dae-Hwan Ahn[1], Jin-Dong Song[1], Woo-Young Choi[2*], and Jae-Hoon Han[1**]

[1]*Center for Opto-Electronic Materials and Devices, KIST*

[2]*Department of Electrical and Electronic Engineering, Yonsei University, Korea*

[3]*Contributed equally to this work.*

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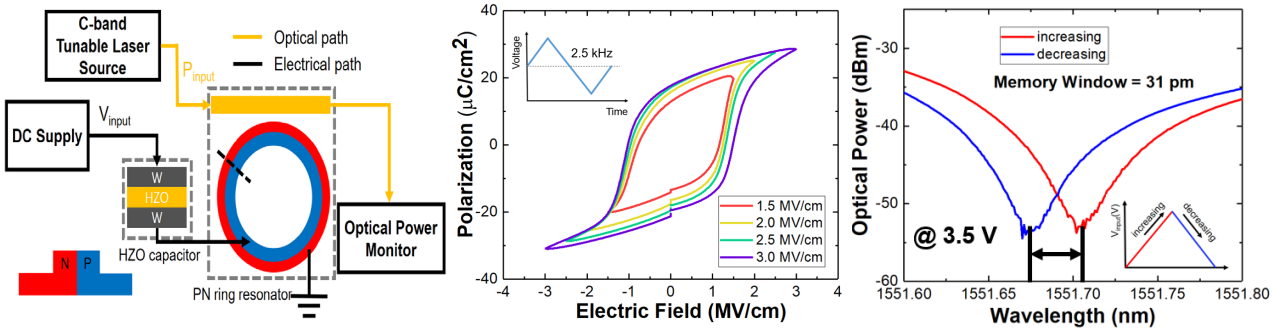
High performance optical phase shifters for photonic integrated circuits (PICs) have been demostrated for large-scale photonic computing and neuromorphic computing [1]. Especially, an optical phase shifter with non-volatile materials such as $BaTiO_3$ [2] or GeSbTe [3] is widely investigated to achieve low power consumption through its non-volatile phase or intensity modulation. In this paper, the non-volatile phase shift operation was investigated using a Si PN ring resonator and a $HfZrO_2$ (HZO) capacitor, which are CMOS-compatible [4]. Figure 1(a) shows the schematic of the measurement setup. The Si PN ring resonator is connected with the HZO capacitor in a series. The P-E curve of the HZO capacitor is shown in Fig. 1(b). When the electric field applied at the HZO capacitor is higher, the polarization of the HZO capacitor is also higher. To confirm the optical characteristics, the triangular shape DC bias was applied between 0 V to 5 V as shown in the inset of Fig. 1(c). The tunable resonance wavelength shift was confirmed by different applied biases. The maximum memory window was 31 pm at 3.5 V between increase and decrease bias (Fig 1. (c)). As a result, we confirmed the resonance wavelength shift of the PN ring resonator according to the polarization of the HZO capacitor. This device will be a promising solution for a CMOS-compatible and low-power optical phase shifter of PICs and neuromorphic photonics.



(a) (b) (c)

Fig.1. (a) Schematic of HZO capacitor & PN ring resonator series connection measurement setup, (b) P-E curve of HZO capacitor, (c) optical power as a function of wavelength at 3.5 V DC bias voltage.

Acknowledgments This work was partially supported by the KIST Institutional Program of Internal Research Program (2E31011), the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2019M3F3A1A0207206912).

References [1] Wim Bogaerts *et al*., "Programmable photonic circuits", *Nature*, **586**, 2020. [2] Pascal Stark *et al*., *OFC*, 2020. [3] Hanyu Zhang *et al., Optics Letters*, **43**, 2018. [4] Seung-Min Han *et al., OFC*, 2021.